

Abstract Submitted
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Optimization of an axial injection plasma torch using numerical analysis¹ ILKER UZUN-KAYMAK², GIRAY MECIT, DEVRIM OZDEMIR, ECE I. SUNGUR, Middle East Tech Univ — Axial Injection plasma torch is a surfaguide microwave plasma source operated at 2.45 GHz. The system can operate at power settings up to 2kW. The plasma is formed inside a 20mm diameter quartz tube using Argon gas. The aim of this study is to understand and optimize the plasma flow characteristics for the purpose of the material interactions. The experimental setup is modeled using COMSOL Multiphysics® Computational Fluid Dynamics Module. The geometry of the flow can be altered using nozzle extensions. Meanwhile different microwave power settings alter the gas temperature hence the viscosity. Images from the plasma torch are captured via Z type Schlieren imaging. It has been observed that the higher mass flow rates require a turbulent model. Reynolds Averaged Navier Stokes (RANS) and Large Eddy Simulation (LES) approaches are compared with the real data. Simulations are conducted using parameter sweeping at different flow rates. In addition to the COMSOL Multiphysics® we are also developing our Python code using libraries from the FEniCS project. The aim is to find critical limits of the geometry and flow for the plasma jet to be effectively used in material processing.

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